気圧センサー

DT015-1（0-700kPa）/ DT015（150-1150mbar）

取扱説明書

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1. はじめに

気圧センサーは MultiLogPRO データロガーおよび NOVA LINK（USB Link）に接続して使用する絶対気圧が測定可能なセンサーです。センサー内部にシールされたゼロ圧力基準と外圧とを比較して測定します。測定範囲は DT015-1 が 0～700kPa（0～6.9 気圧 / 0～7000mbar）、DT015 が 150～1150mbar（0.148～1.134 気圧 /15～115kPa）です。DT015-1 にはルアーロックコネクタのついたチューブがつながっています。また調整用のネジも備えています。

2. 動作原理

圧力の検知には感圧性の薄膜が使用されています。この薄膜は圧力を受けることで曲がりが生じ、抵抗値を変化させます。抵抗値が変化することでオームの法則により電圧も変化します。この電圧は 0～5V の範囲で変化し、データロガーの A/D コンバータに接続されます。圧力値はこの電圧を元に換算され、データロガーに保存されます。

3. 仕様

	DT015-1	DT015
測定範囲	0 ～ 700 kPa	150 ～ 1150 mbar
精度	±3 % F.S.	±1 % F.S.
分解能（12bit）	0.18 kPa	0.25 mbar
サンプリングレート	10 サンプリング／秒	10 サンプリング／秒
応答時間（90%）	1 ms	1 ms
使用温度範囲	0 ～ 85℃	0 ～ 85℃

4. 調整

基本的に調整は必要としませんが、DT015-1 には本体ケース裏面に調整用ネジがあります。小さなマイナスドライバで調整を行ってください。必要な場合にのみ行ってください。

5. 使用方法

5.1. MultiLogPRO データロガーを使用

①気圧センサーをデータロガーの I/O-1 に接続します。
②データロガーの電源を ON します。
③System Configuration の Input Mode を Auto ID に設定します。
④Setup the logger の In-1 が DT015-1 接続時は Press. 700 kP、DT015 接続時は Press. 1150mB になっていることを確認します。
※System Configuration の Input Mode が 8 input でお使いの場合は任意に [<] [>] ボタンで Press. 700 kP（DT015-1）または Press. 1150mB（DT015）に合わせてください。
⑤RATE を設定します。設定後、エンターボタンを押します。
⑥SAMPLES（データサンプル数）を設定します。設定後、エンターボタンを押します。
⑦DISPLAY を設定します。データロガーでどのように表示するかを選択します。
⑧[ESC]ボタンを押します。
⑨Start logging を選択します。エンターボタンを押すとデータロギングが開始されます。

5.2. MultiLab を使用（MultiLogPRO／NOVA LINK）

①距離センサーをデータロガーの I/O-1 に接続します。
②データロガーの電源を ON します。
③MultiLab ソフトウェアを起動します。
④データロガーをパソコンに接続します。
⑤Setup Wizard をクリックし、センサーの設定、サンプリングレートおよびサンプリング数等の設定を行います。
⑥Run をクリックします。測定が開始されます。

Pressure (0 - 700 kPa) DT015-1

The Pressure sensor (0 - 700 kPa) can be connected to the NOVA5000, NOVA LINK or MultiLogPRO data loggers.

The Pressure sensor (0 - 700 kPa) is an absolute gas pressure sensor. It measures applied external pressure relative to zero pressure reference sealed inside the sensor. The Pressure sensor's range is 0 - 700 kPa (0 - 6.9 atm or 0 – 7000 mbar).

The sensor includes a plastic tube with a Luer Lock Connector, suitable for experiments in small containers as syrings and valves.

The Pressure sensor is used for various experiments in Biology, Chemistry and Physics.

The sensor is housed in the Fourier Systems plastic sensor case and is equipped with an offset calibration screw.

Typical Experiments

- Boyle's Law
- Gay-Lussac's Law
- Measuring rate of chemical reaction

How it Works

The main sensing unit inside the Pressure sensor is composed of a pressure sensitive membrane, and a flexible resistor attached to it. This flexible resistor changes its resistance when it bends. When the pressure alters, the resistance changes, and according to Ohm’s Law so does the voltage drop across it. This voltage is then amplified to a range of 0 - 5 V, accepted by the Analog-Digital converter of the data logger. The pressure is then calculated and recorded in the logger’s memory.

Sensor Specification

Range:	0 - 700 kPa
Accuracy:	±3 % over entire range
Resolution (12-bit):	0.18 kPa
Default Sample Rate:	10 samples per second
Response Time (for 90% change in reading):	1 ms
Operating Temperature:	0 °C to 85 °C
Features:	Equipped with an offset calibration screw

Calibration

The Pressure sensor (0 - 700 kPa) requires no calibration.

For further calibration an offset calibration screw is located at the back of the sensor case. Apply a known reference pressure to the sensor and start recording. Insert a flat screwdriver to the calibration hole and slowly turn the calibration screw until the reference value is reached.

Using the Pressure Sensor with the NOVA5000 and MultiLab Software

1. Launch the MultiLab CE software.
2. Connect the Pressure sensor to the NOVA5000's sensor input (starting from I/O-1). The sensor is automatically recognized by the MultiLab software.
3. Click **Setup** on the main toolbar and program the data logger's sample rate and number of samples. Click **Run** on the main toolbar to start the measurement.

Using the Pressure Sensor with the NOVA LINK or MultiLogPRO and MultiLab Software

1. Launch the MultiLab software.
2. Connect the Pressure sensor to the data logger's sensor input (starting from I/O-1). The sensor is automatically recognized by the MultiLab software.
3. Click **Setup** on the main toolbar and program the data logger's sample rate and number of samples. Click **Run** on the main toolbar to start the measurement.

Selecting units

MultiLab displays the data in kPa. To change the display to millibar or atmosfer:

1. Click **Setup** on the main toolbar.
2. Click **Properties** next to the Pressure sensor input.
3. Select the checkbox next to the desired Pressure unit and click **OK**.

Setting the Current Reading of the Pressure Sensor to Zero

1. Launch the MultiLab software (from either your PC or NOVA5000).
2. Connect the Pressure sensor to the data logger's first sensor input I/O-1. The sensor is automatically recognized by the MultiLab software.
3. Click **Setup** on the main toolbar.
4. Click **Properties** next to the **Pressure sensor** input.
5. Click the **Set Zero** tab.
6. Check the box next to **Set the current reading to zero**.
7. Click **OK**.
8. Program the data logger's sample rate and number of samples. Click **Run** on the main toolbar to start the measurement.

An Example of using the Pressure Sensor

Boyle's Law

Gases are distinguished from liquids and solids by their ability to be compressed into much smaller volumes. According to Boyle's Law, the volume of a sample of gas at a given temperature varies inversely with the applied pressure: $P \propto 1/V$.

In this experiment we investigate the relationships between pressure and volume, by measuring the effects of changes in air volume on the pressured air, sealed in a flask at a constant temperature.

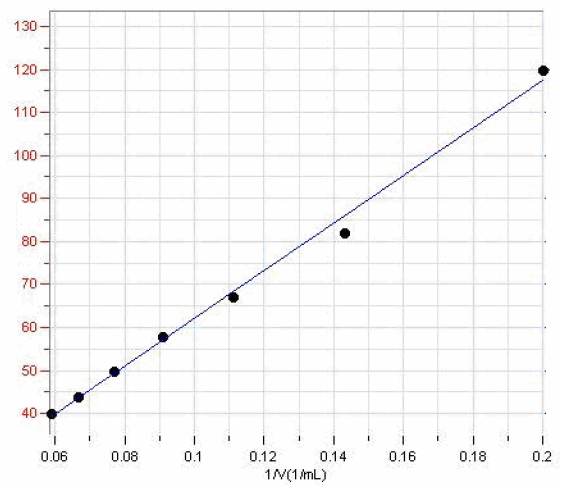

Figure 1: Graph of Pressure vs. 1/Volume at a constant temperature

Pressure (150 - 1150 mbar) DT015

The Pressure sensor (150 - 1150 mbar) can be connected to the NOVA5000, NOVA LINK or MultiLogPRO data loggers.
The Pressure sensor (150 - 1150 mbar) is an absolute gas pressure sensor. It measures applied external pressure relative to zero pressure reference sealed inside the sensor. The sensor is housed in Fourier's plastic sensor case and its range is 150 - 1150 mbar (0.148 - 1.134 atm or 15 - 115 kPa).

The Pressure sensor is used for various experiments in Biology, Chemistry and Physics. It is furthermore used as an altimeter (measuring the height you are at) and as a barometer for various meteorological measurements.

Typical Experiments

- Investigating the evaporation of water from terrestrial plants - transpiration
- Measuring the photosynthesis rate in water plants
- Measuring the respiration rate of germinating seeds
- Investigating the effect of light on photosynthesis rate
- Investigating the Ideal Gas Law

How it Works

The main sensing unit inside the Pressure sensor is composed of a pressure sensitive membrane, and a flexible resistor attached to it. This flexible resistor changes its resistance when it bends. When the pressure alters, the resistance changes, and according to Ohm's Law so does the voltage drop across it. This voltage is then amplified to a range of 0 - 5 V, accepted by the Analog-Digital converter of the data logger. The pressure is then calculated and recorded in the logger's memory.

Sensor Specification

Range:	150 -1150 mbar
Accuracy:	±1 % over entire range
Resolution (12-bit):	0.25 mbar
Default Sample Rate:	10 samples per second
Response Time (for 90% change in reading):	1 ms
Operating Temperature:	0 - 85 °C

Calibration

The Pressure sensor (150 to 1150 mbar) requires no calibration.

Using the Pressure Sensor with the NOVA5000 and MultiLab Software

1. Launch the MultiLab CE software.
2. Connect the Pressure sensor to the NOVA5000's sensor input (starting from I/O-1). The sensor is automatically recognized by the MultiLab software.
3. Click **Setup** on the main toolbar and program the data logger's sample rate and number of samples. Click **Run** on the main toolbar to start the measurement.

Using the Pressure Sensor with the NOVA LINK or MultiLogPRO and MultiLab Software

1. Launch the MultiLab software.
2. Connect the Pressure sensor to the data logger's sensor input (starting from I/O-1). The sensor is automatically recognized by the MultiLab software.
3. Click **Setup** on the main toolbar and program the data logger's sample rate and number of samples. Click **Run** on the main toolbar to start the measurement.

Selecting units

MultiLab displays the data in mbar. To change the display to kPa or atmosfer:

1. Click **Setup** on the main toolbar.
2. Click **Properties** next to the Pressure sensor input.
3. Select the checkbox next to the desired Pressure unit.
4. Click **OK**.

Setting the Current Reading of the Pressure Sensor to Zero

1. Launch the MultiLab software (PC or NOVA5000).
2. Connect the Pressure sensor to the data logger's first sensor input I/O-1.
3. The Pressure sensor is automatically recognized by the MultiLab software.
4. Click **Setup** on the main toolbar.
5. Click **Properties** next to the Pressure sensor input.
6. Click the **Set Zero** tab.
7. Check the box next to **Set the current reading to zero**.
8. Click **OK**.
9. Program the data logger's sample rate and number of samples. Click **Run** on the main toolbar to start the measurement.

An Example of using the Pressure Sensor

Photosynthesis rate in water plant - Elodea

The following graph shows the example for a photosynthesis experiment where the increase of pressure caused by formed oxygen is followed in comparison to the ambient pressure.

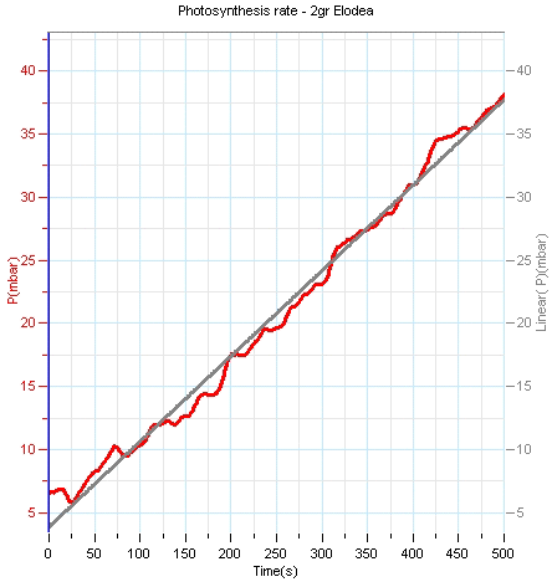

Figure 1: A Photosynthesis experiment performed using the Pressure sensor